

Notice of Allowability

Application No.

10/647,527

Examiner

Shi K. Li

Applicant(s)

VOLKENING, FRED ALLAN

Art Unit

2613

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed 5 February 2007 and interview dated 26 April 2007.
2. ☒ The allowed claim(s) is/are 1,3-21,23-27,29-43,45-47,49,51 and 55.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date 1/30/2004
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☒ Other approved drawing.



SHI K. LI

PRIMARY PATENT EXAMINER

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EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR

1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Patrick J. Finnan on 26 April 2007.

The application has been amended as follows:

The list of claims, which begins on the next page, replaces all prior versions.

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Listing of Claims:

1. (Currently Amended) A photonic channelized receiver, comprising:
 - an optical source, of the receiver, that produces a plurality of optical signals at respective, spaced wavelengths;
 - an optical combiner, of the receiver, configured to combine the plurality of optical signals into a common beam;
 - an electro-optical modulator, of the receiver, that modulates the common beam with an RF signal to produce sidebands offset from frequencies of the plurality of optical signals by the frequency of the RF signal;
 - an etalon having a periodic transfer function that filters the modulated common beam such that the optical signals in the filtered, modulated common beam function as receiver channels corresponding to respective different RF frequencies, wherein the plurality of optical signals corresponds to a plurality of respective frequency channels and the etalon has a plurality of etalon transmission peaks corresponding to the respective frequency channels, such that a frequency offset between a frequency channel's etalon transmission peak and optical signal varies among the frequency channels;
 - a wavelength splitter configured to separate the filtered, modulated common beam into a plurality of channel output signals whose intensities are a function of the frequency of the RF signal; and
 - a plurality of detectors that respectively measure the intensities of the channel output signals to indicate the frequency of the RF signal.
2. (Canceled)
3. (Currently Amended) The photonic channelized receiver of claim [[2]] 1, wherein each frequency channel corresponds to an RF frequency that is a function of the offset between the frequency channel's etalon transmission peak and optical signal.

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4. (Original) The photonic channelized receiver of claim 1, wherein the optical signals are substantially equally spaced with a first frequency spacing, and the etalon has periodic transmission peaks that are substantially equally spaced with a second frequency spacing different from the first frequency spacing, such that frequency offsets between corresponding optical signals and etalon transmission peaks vary for successive optical signals.

5. (Original) The photonic channelized receiver of claim 1, wherein the optical source comprises a plurality of continuous wave (CW) lasers.

6. (Original) The photonic channelized receiver of claim 1, wherein the optical source comprises a plurality of continuous wave (CW) Dense Wavelength Division Multiplexed (DWDM) Communications laser sources.

7. (Original) The photonic channelized receiver of claim 1, further comprising Dense Wavelength Division Multiplexed (DWDM) wavelength lockers that lock the optical source to set wavelength offsets from ITU grid wavelengths.

8. (Original) The photonic channelized receiver of claim 1, wherein the optical combiner comprises a Dense Wavelength Division Multiplexer.

9. (Original) The photonic channelized receiver of claim 1, wherein the electro-optical modulator comprises an electro-optical phase modulator.

10. (Previously Presented) The photonic channelized receiver of claim 9, wherein the electro-optical phase modulator comprises a lithium niobate electro-optical phase modulator.

11. (Original) The photonic channelized receiver of claim 1, wherein the electro-optical modulator comprises an amplitude modulator.

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12. (Original) The photonic channelized receiver of claim 11, wherein the electro-optical amplitude modulator comprises a Mach-Zehnder amplitude modulator.

13. (Original) The photonic channelized receiver of claim 1, wherein the etalon comprises a Fabry-Perot etalon.

14. (Original) The photonic channelized receiver of claim 1, wherein the etalon comprises a fiber-coupled high-finesse etalon.

15. (Original) The photonic channelized receiver of claim 1, wherein the wavelength splitter comprises a Dense Wavelength Division Demultiplexer.

16. (Original) The photonic channelized receiver of claim 1, wherein the wavelength splitter comprises a fiber-coupled device.

17. (Original) The photonic channelized receiver of claim 1, wherein the detectors are high speed optical detectors whose outputs yield near real time measurement of the RF signal.

18. (Original) The photonic channelized receiver of claim 1, wherein optical source is one of a plurality of optical sources operating in parallel and the electro-optical modulator is one of a plurality of respective electro-optical modulators operating in parallel to provide a wideband channelized receiver capability.

19. (Original) The photonic channelized receiver of claim 1, comprising a plurality of corresponding optical sources, electro-optical modulators and etalons operating at different frequency bands to provide a respective plurality of receiver channel bandwidths.

20. (Original) The photonic channelized receiver of claim 1, wherein photonic channelized receiver is a photonic RF spectrum analyzer.

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21. (Currently Amended) A photonic channelized receiver, comprising:

- means for producing a plurality of optical signals at respective, spaced wavelengths at the receiver;
- means for combining the plurality of optical signals into a common beam at the receiver;
- means for modulating the common beam with an RF signal to produce sidebands offset from frequencies of the plurality of optical signals by the frequency of the RF signal at the receiver;
- means for filtering the modulated common beam such that the plurality of optical signals in the filtered, modulated common beam function as receiver channels corresponding to respective different RF frequencies, wherein the plurality of optical signals corresponds to a plurality of respective frequency channels and the means for filtering produces filter transmission peaks corresponding to the respective frequency channels, such that a frequency offset between a frequency channel's filter transmission peak and optical signal varies among the frequency channels;
- means for separating the filtered, modulated common beam into a plurality of channel output signals whose intensities are a function of the frequency of the RF signal; and
- means for measuring the intensities of the channel output signals to indicate the frequency of the RF signal.

22. (Canceled)

23. (Currently Amended) The photonic channelized receiver of claim [[22]] 21, wherein each frequency channel corresponds to an RF frequency that is a function of the offset between the frequency channel's filter transmission peak and optical signal.

24. (Original) The photonic channelized receiver of claim 21, wherein the optical signals are substantially equally spaced with a first frequency spacing, and the means for filtering has periodic transmission peaks that are substantially equally spaced with a second frequency spacing different from the first frequency spacing, such that frequency offsets between corresponding optical signals and filter transmission peaks vary for successive optical signals.

25. (Original) the photonic channelized receiver of claim 21, wherein the means for modulating phase modulates the common beam.

26. (Original) the photonic channelized receiver of claim 21, wherein the means for modulating amplitude modulates the common beam.

27. (Currently Amended) A photonic channelized receiver, comprising:

- an optical source, of the receiver, that produces a plurality of optical signals at respective, spaced wavelengths, wherein each of the plurality of optical signals is modulated with an RF signal to produce sidebands offset from frequencies of the plurality of optical signals by the frequency of the RF signal;
- an optical combiner, of the receiver, configured to combine the plurality of optical signals into a common beam;
- an etalon having a periodic transfer function that filters the common beam such that the optical signals in the filtered common beam function as receiver channels corresponding to respective different RF frequencies, wherein the plurality of optical signals corresponds to a plurality of respective frequency channels and the etalon has a plurality of etalon transmission peaks corresponding to the respective frequency channels, such that a frequency offset between a frequency channel's etalon transmission peak and optical signal varies among the frequency channels;
- a wavelength splitter configured to separate the filtered common beam into a plurality of channel output signals whose intensities are a function of the frequency of the RF signal; and
- a plurality of detectors that respectively measure the intensities of the channel output signals to indicate the frequency of the RF signal.

28. (Canceled)

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29. (Currently Amended) The photonic channelized receiver of claim ~~[[28]]~~ 27, wherein each frequency channel corresponds to an RF frequency that is a function of the offset between the frequency channel's etalon transmission peak and optical signal.

30. (Original) The photonic channelized receiver of claim 27, wherein the optical signals are substantially equally spaced with a first frequency spacing, and the etalon has periodic transmission peaks that are substantially equally spaced with a second frequency spacing different from the first frequency spacing, such that frequency offsets between corresponding optical signals and etalon transmission peaks vary for successive optical signals.

31. (Original) The photonic channelized receiver of claim 27, wherein the optical source comprises a plurality of continuous wave (CW) lasers.

32. (Original) The photonic channelized receiver of claim 27, wherein the optical source comprises a plurality of continuous wave (CW) Dense Wavelength Division Multiplexed (DWDM) Communications laser sources.

33. (Original) The photonic channelized receiver of claim 27, further comprising Dense Wavelength Division Multiplexed (DWDM) wavelength lockers that lock the optical source to set wavelength offsets from ITU grid wavelengths.

34. (Original) The photonic channelized receiver of claim 27, wherein the optical combiner comprises a Dense Wavelength Division Multiplexer.

35. (Original) The photonic channelized receiver of claim 27, wherein the etalon comprises a Fabry-Perot etalon.

36. (Original) The photonic channelized receiver of claim 27, wherein the etalon comprises a fiber-coupled high-finesse etalon.

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37. (Original) The photonic channelized receiver of claim 27, wherein the wavelength splitter comprises a Dense Wavelength Division Demultiplexer.

38. (Original) The photonic channelized receiver of claim 27, wherein the wavelength splitter comprises a fiber-coupled device.

39. (Original) The photonic channelized receiver of claim 27, wherein the detectors are high speed optical detectors whose outputs yield near real time measurement of the RF signal.

40. (Original) The photonic channelized receiver of claim 27, wherein photonic channelized receiver is a photonic RF spectrum analyzer.

41. (Currently Amended) A method of detecting an RF signal, comprising:

- a) generating a plurality of optical signals at respective, spaced wavelengths;
- b) combining the plurality of optical signals into a common beam;
- c) modulating the common beam with the RF signal to produce sidebands offset from frequencies of the plurality of optical signals by the frequency of the RF signal;
- d) filtering the modulated common beam with an etalon, such that the optical signals in the filtered, modulated common beam function as receiver channels corresponding to respective different RF frequencies, wherein the plurality of optical signals correspond to a plurality of respective frequency channels and the etalon has a plurality of etalon transmission peaks corresponding to the respective frequency channels, such that a frequency offset between a frequency channel's etalon transmission peak and optical signal varies among the frequency channels;
- e) separating the filtered, modulated common beam into a plurality of channel output signals whose intensities are a function of the frequency of the RF signal; and
- f) measuring the intensities of the channel output signals to determine the frequency of the RF signal.

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42. (Original) The method of claim 41, wherein (c) includes phase modulating the common beam with the RF signal.

43. (Original) The method of claim 41, wherein (c) includes amplitude modulating the common beam with the RF signal.

44. (Canceled)

45. (Currently Amended) The method of claim ~~[[44]]~~ 41, wherein each frequency channel corresponds to an RF frequency that is a function of the offset between the frequency channel's etalon transmission peak and optical signal.

46. (Original) The method of claim 41, wherein the optical signals are substantially equally spaced with a first frequency spacing, and the etalon has periodic transmission peaks that are substantially equally spaced with a second frequency spacing different from the first frequency spacing, such that frequency offsets between corresponding optical signals and etalon transmission peaks vary for successive optical signals.

47. (Currently Amended) A method of detecting an RF signal, comprising:

- a) generating a plurality of optical signals at respective, spaced wavelengths;
- b) modulating the plurality of optical signals to produce sidebands offset from frequencies of the plurality of optical signals by the frequency of the RF signal;
- c) combining the plurality of modulated optical signals into a common beam;
- d) filtering the common beam with an etalon, such that the optical signals in the filtered common beam function as receiver channels corresponding to respective different RF frequencies, wherein the plurality of optical signals correspond to a plurality of respective frequency channels and the etalon has a plurality of etalon transmission peaks corresponding to the respective frequency channels, such that a frequency offset between a frequency channel's etalon transmission peak and optical signal varies among the frequency channels;

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e) separating the filtered common beam into a plurality of channel output signals whose intensities are a function of the frequency of the RF signal; and

f) measuring the intensities of the channel output signals to determine the frequency of the RF signal.

48. (Canceled)

49. (Previously Presented) The photonic channelized receiver of claim 1, wherein the plurality of detectors correspond to different RF frequencies and the photonic channelized receiver compares intensities of the channel output signals of the detectors to determine the frequency of the RF signal.

50. (Canceled)

51. (Previously Presented) The photonic channelized receiver of claim 27, wherein the plurality of detectors correspond to different RF frequencies and the photonic channelized receiver compares intensities of the channel output signals of the detectors to determine the frequency of the RF signal.

52-54. (Canceled)

55. (Previously Presented) The photonic channelized receiver of claim 1, wherein the receiver further comprises an RF antenna for receiving the RF signal.

Reason for Allowance

2. The following is an examiner's statement of reasons for allowance:

3. The prior art made of record is considered pertinent to applicant's disclosure.

Spezio (U.S. Patent 4,468,766) teaches in FIG. 1 an optical RF downconverter comprising light source, modulator and detectors.

Davis (U.S. Patent 6,901,224 B1) teaches in FIG. 1 an RF signal channelizer.

Yap et al. (U.S. Patent 7,085,499 B2) teaches in FIG. 1 a waveform synthesis comprising optical comb generator, modulator and photodetector.

Wang et al. (W. Wang et al., "Characterization of a Coherent Optical RF Channelizer Based on a Diffraction Grating", IEEE Transactions on Microwave Theory and Techniques, Vol. 49, No. 10, October 2001) teaches in FIG. 1 a coherent optical channelizing receiver using optical frequency comb.

The prior art fails to teach or render obvious "an etalon have a periodic transfer function that filters the modulated common beam such that the optical signals in the filtered, modulated common beam function as receiver channels corresponding to respective different RF frequencies, wherein the plurality of optical signals corresponds to a plurality of respective frequency channels and the etalon has a plurality of etalon transmission peaks corresponding to the respective frequency channels, such that a frequency offset between a frequency channel's etalon transmission peak and optical signal varies among the frequency channels", as recited in claim 1, in combination with the other limitations. The other independent claims 21, 27 and 41 recite similar limitations.

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Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shi K. Li whose telephone number is 571 272-3031. The examiner can normally be reached on Monday-Friday (7:30 a.m. - 4:30 p.m.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571 272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

skl
26 April 2007


SHI K. LI
PRIMARY PATENT EXAMINER

4/27/2007

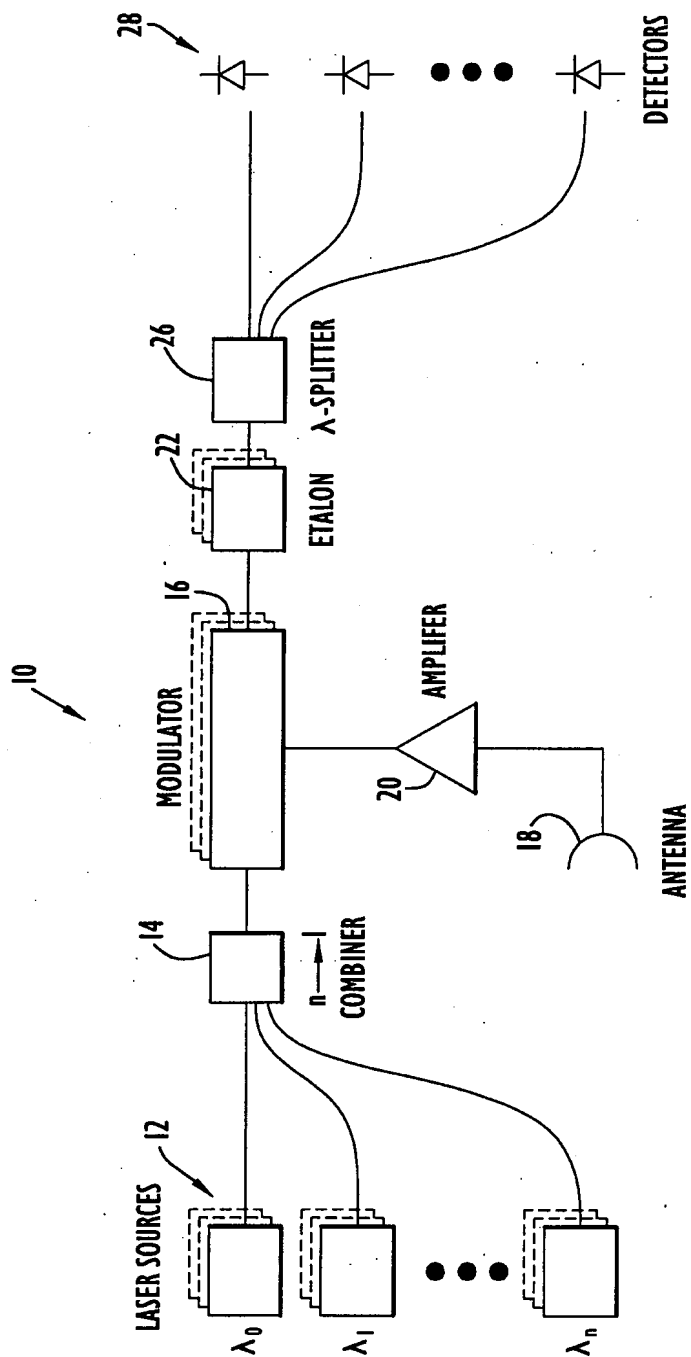


FIG. 1